IS 11611 (1992): Fire test for valves (including soft seated quarter turn valves) - Method of test [MED 17: Chemical Engineering Plants and Related Equipment]

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IS 11611 : 1992

(Reaffirmed 2003)

भारतीय मानक

वाल्वों के लिये अग्नि परीक्षण (मृदु आधार चौथाई घुमाने वाले वाल्व सहित) — परीक्षण पद्धति

(पहला पुनरीक्षण)

Indian Standard

FIRE TEST FOR VALVES (INCLUDING SOFT SEATED QUARTER TURN VALVE) — METHOD OF TEST

(First Revision)

UDC 621·696·616 : 620·193·5

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

December 1992

Price Group 5

Chemical Engineering Plants and Related Equipment Sectional Committee, HMD 17

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Chemical Engineering Plants and Related Equipment Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

This standard was first published in 1986. This revision of the standard has been brought out to bring it in line with international practices.

Fire testing of valves is potentially very hazardous and it is essential that safety of personnel be given prime consideration. Because of the possible design of the test value, test equipment and nature of the test programme, the potential may exist for a hazardous rupture of pressure boundary components. The use of adequate shields in the area of the test enclosure and other means for the protection of personnel conducting the test is absolutely necessary.

In this standard it has been assumed that the execution of its provisions is entrusted to qualified and experienced persons, because it calls for procedures that may prove dangerous if proper precautions are not taken.

This standard refers only to technical capabilities and suitability and does not absolve the user and/or manufacturer from legal obligations relating to health and safety at any stage.

In the formulation of this standard assistance has been derived from the following publications:

a) ISO/DIS 10497 'Testing of valves — Fire type testing requirements', issued by International Organization for Standardization.

b) BS 6755 (Part 2) : 1987 'Testing of valves — Part 2 Specification for fire type testing requirements', issued by British Standards Institution.

c) API STANDARD 607, 3rd Edition, November 1985 'Fire test for soft seated quarter turn valves', issued by American Petroleum Institute, USA.

d) API Spec 6 FA, First Edition, May 1985 'Specification for fire test for valves', issued by American Petroleum Institute, USA.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

FIRE TEST FOR VALVES (INCLUDING SOFT SEATED QUARTER TURN VALVE) — METHOD OF TEST

(First Revision)

1 SCOPE

1.1 This Indian Standard specifies the requirements for testing and establishing the pressure containing ability and leakage rate of valves when exposed to fire.

1.2 The performance requirements in this document are intended to establish the limits of acceptability regardless of size and pressure rating.

1.3 The maximum acceptable leakage rates specified in this standard are for test temperatures and pressures as given in this standard. Rates at other temperatures and pressures may be substantially different.

1.4 This standard does not cover the requirements for valve actuators other than manually operated gear boxes or other similar mechanisms when these form a part of the normal valve assembly. Other type of valve actuators, for example, electrical, pneumatic and hydraulic may need special protection to operate in the environments as specified in this standard. Fire test of such actuators is beyond the scope of this standard.

1.5 This standard defines the fire conditions for the test and method of exposure of valve to these conditions. It is recognized that modifications may be necessary in certain cases and they shall be subject to agreement between manufacturer and buyer/authority witnessing the test.

2 REFERENCES

The Indian Standards listed below are necessary adjuncts to this standard:

IS No.	*Title*
554 : 1985	Dimensions for pipe threads where pressure tight joints are required on the threads (*third revision*)
2054 : 1962	Reference tables for nickel/chromium-nickel/aluminium thermocouples
2055 : 1962	Reference tables for platinum/rhodium platinum thermocouples

3 BASIS OF FIRE TEST

3.1 The test procedure specified in this standard is intended to simulate the circumstances which will impose severe demands on a valve.

3.2 The test duration/burn period has been established on the basis that it represents the maximum time required for extinguishing most refinery and chemical plant fires. Fires of longer duration are considered to be of major magnitude, with consequences greater than those anticipated by this test.

3.3 Potential piping-to-valve and connection joint leakage is not evaluated as part of this test and is not included in the allowable external leakage specified in **9**. Hence, for the purpose of this test, it may be necessary to modify these joints to eliminate leakage.

4 SAFETY PROVISION

In the interest of the safety of the personnel conducting the test and because of the environmental conditions, the following requirements are included in the procedure.

4.1 All the test equipment and the test valve itself shall be clean and in good operating condition.

4.2 All the piping shall be of seamless type and shall be of sufficient wall thickness.

4.3 The valve shall be preferably tested inside an enclosure or a pit adequately covered on the top, so that in the event of a rupture, the blast does not result in injury to personnel conducting and witnessing the test. The enclosure and the cover shall be of adequate thickness and strength to resist and minimise the force of the blast.

4.4 There shall be a minimum clearance of 150 mm in the horizontal plane between the enclosure and any part of the valve. The minimum height of the enclosure above the top of the valve shall be 150 mm.

4.5 Water shall be used as test medium.

4.6 Gaseous fuel shall be used for burning. The fuel reservoir(s) shall be at least 6 metres away

from the enclosure and shall preferably be fitted with quick shut-off device(s).

4.7 It is recommended that the body cavity of the valve designed to trap liquid in closed condition, shall be provided with a separate pressure relieving provision to protect against any potential rupture. This is in addition to any pressure relief device fitted on the valve body as a part of the design.

5 DIRECTION AND CONDITIONS FOR VALVES TO BE TESTED

5.1 Symmetrical valves intended for bi-directional use shall be tested in one direction only.

5.2 Valves with asymetrical closure elements, intended for bi-directional installation, shall be tested by carrying out the test procedure twice, once in each direction of potential installation. The same valve may be refurnished, or otherwise, an identical valve may be tested in another direction.

5.2.1 Some examples of unacceptable testing based on one side testing are:

a) testing with end flange/retainer on the upstream side for a single piece valve; and

b) body gasket on the upstream side for two piece valve.

5.3 Valves intended for unidirectional installation are marked accordingly and shall be tested in the direction of recommended installation.

5.4 If the valve being tested is fitted with a gearbox or other such manual device, then only that particular assembly shall qualify. In cases where a valve is supplied either fitted with or without a gearbox, testing with a gearbox fitted will qualify the valve without the gearbox but not *vice versa*. When valves are paragraph tested with gearboxes, it is to be ensured that exposure of stem sealing of the valve to fire will be as would be the case when valves are tested without gearboxes.

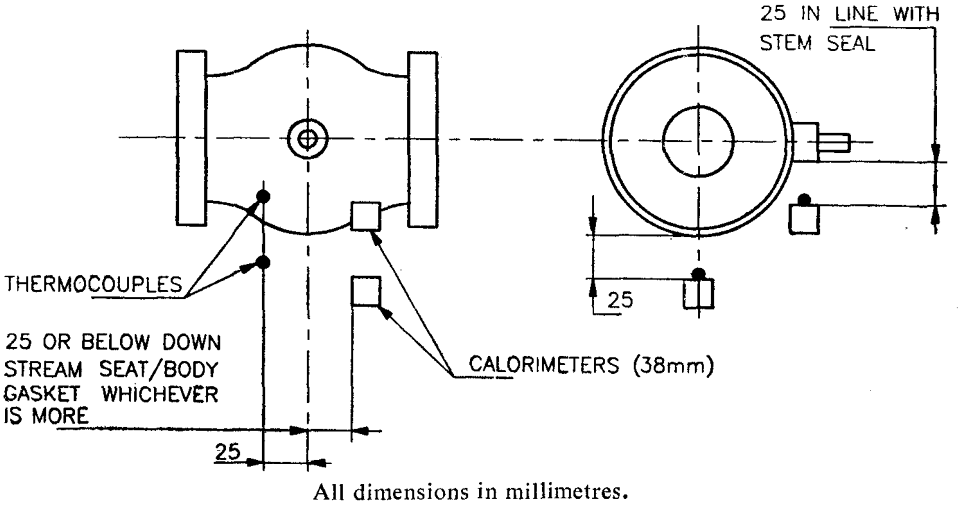
6 TEST CONDITIONS

6.1 Valves (and gear boxes) shall not be protected with insulating materials of any form during the testing, except where such protection is part of the design of the component(s).

6.2 The valve shall be tested in closed position with the stem and bore in horizontal position.

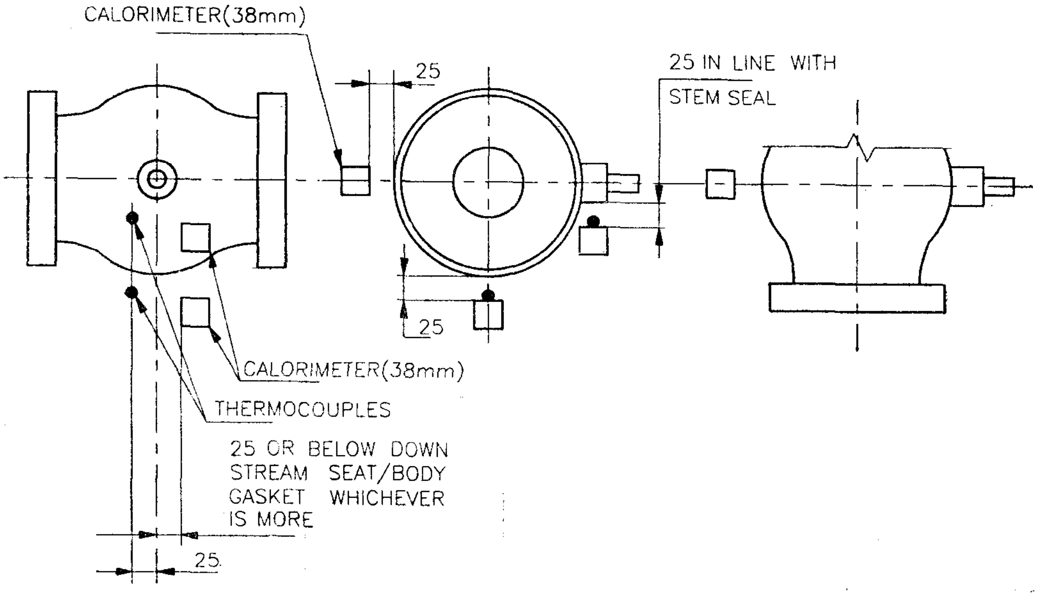
6.3 The valve shall be enveloped in flame having a temperature of 760°C to 1 000°C for a minimum period of 30 minutes. The flame temperature shall be the average of at least two thermocouple readings with no thermocouple reading less than 710°C. One thermocouple shall be located 25 mm beneath the valve body and the other within 25 mm radius of the stem seal as shown in Fig. 1 and 2. During the progress of the test, to control body and calorimeter temperatures, flame size and temperatures may be controlled. However, it is to be ensured that the valve is completely enveloped in flame. If necessary, more number of burners may be employed.

6.4 The test set up shall include 38 mm calorimeter cubes of carbon steel with the sensing zone of the thermocouple located at the centre of the block as shown in Fig. 3. For valve sizes DN 150 and smaller, two blocks shall be located as shown in Fig. 1. For valve sizes DN 200 and larger, three blocks shall be used as shown in Fig. 2. The location of the calorimeter below the body shall be at the position of the downstream seat/body gasket location or at 25 mm whichever is more as shown in Fig. 1 and 2. For smaller sizes, arrangement is to be mutually agreed between witnessing authority and the manufacturer.



All dimensions in millimetres.

FIG. 1 LOCATION OF CALORIMETER CUBES AND FLAME THERMOCOUPLES FOR VALVES SIZE DN 150 AND SMALLER



All dimensions in millimetres.

FIG. 2 LOCATION OF CALORIMETER CUBES AND FLAME THERMOCOUPLES FOR VALVES SIZE DN 200 AND LARGER

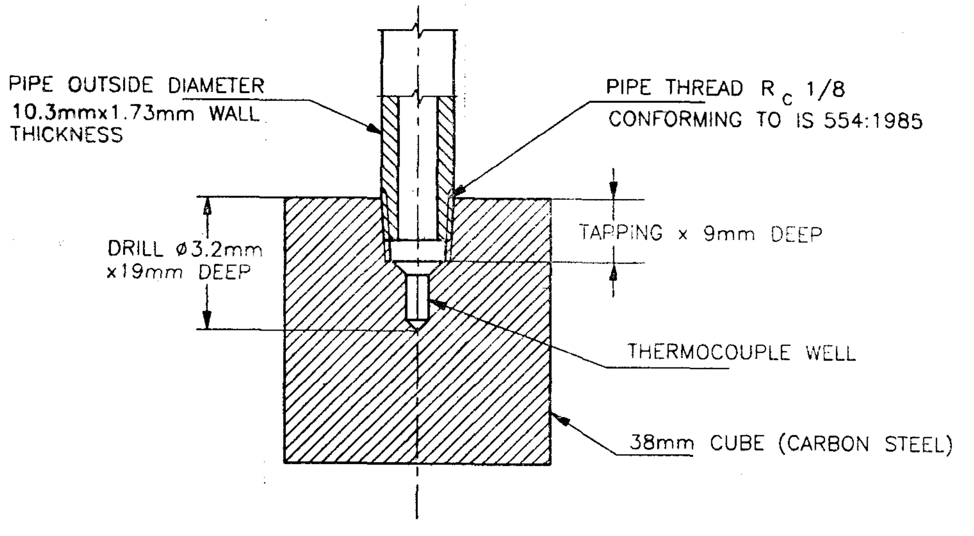
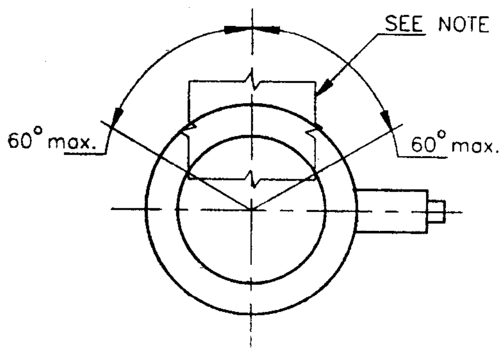


FIG. 3 CALORIMETER CUBE DESIGN AND DIMENSIONS

6.5 During the 30 minute burn period, the average temperature of the calorimeters shall reach 650 C *Min* within 15 minutes or less. During the remainder of the flame exposure, the calorimeters shall maintain a minimum average temperature of 650°C and none of the calorimeters shall read less than 570°C.

6.6 If agreed between the manufacturer, purchaser and witnessing authority for soft seated valves of size DN 150 and larger, temperature of the body material shall be indicated by a thermocouple installed in the body on the top of the valve within 60°C of either side of the vertical centre line as shown in Fig. 4. For valves of larger sizes, at least two thermocouples shall be installed. The temperature of the body shall be average of two thermocouple readings, with all the readings recorded. The thermocouple(s) shall be installed in such a way that the readings are not affected by the flame. The thermocouple(s) shall be recessed in the body by a minimum of 1·6 mm or shall be installed within the body of the valve. The thermocouples are to be positioned nearest to the downstream seat/gasket position.

NOTE — Metal having the same composition as the valve body may be weld deposited on the body for the installation of thermocouple(s), so as not to reduce the effective minimum shell thickness.



NOTE — Body thermocouple(s) to be recessed a minimum of 1·6 mm in this area when installed externally.

FIG. 4 LOCATION OF THERMOCOUPLES

6.7 For upstream sealing valves (for example, some trunion mounted valves), the volume of the liquid trapped in the body cavity at the beginning of the test shall be determined and recorded in the test report. This volume shall be deducted from the liquid collected in the calibrated container during the fire exposure period. It is assumed that during the test, this volume of water would flow through the valve and pass through the downstrem seat and be collected in the container. Since this volume has not actually leaked through the upstream seat, it is to be deducted from the total volume measured in the downstream calibrated container when determining through valve leakage. This is applicable only for the through valve leakage during burn period.

6.8 During the test period, the valve and system shall be subjected to a 'High Test Pressure' as given in Table 1.

6.8.1 For other valves, the test pressure shall be 75 percent of the maximum permissible working pressure at 20°C rounded to the next 1 bar.

6.9 Following the flame exposure and cooling down period, valves having a maximum working pressure of 110 bar or lower, shall be subjected to a 'Low Pressure Test' as given in Table 2.

6.9.1 For all other valves, the test pressure shall be 7 percent of the maximum permissible working pressure at 20°C or 2 bar whichever is greater.

6.10 The test is void if the supplemental pressure relief device described in **4.7** is activated. If the design of the test valve include an externally discharging relief device that relieves during the test, the test is not void; however, all discharge through the device shall be considered external leakage.

NOTE — Qualification based on the use of an external relief device must be so stated in the final test report.

Table 1 Test Pressures for High Pressure Test

(*Clause* 6.8)

PN Rating	Class Rating	Test Pressure, Bar ± 10%
(1)	(2)	(3)
10		8
16		12
20	150	15
25		20
40		30
50	300	37
64	400	50
100	600	75
150	900	112
250	1 500	192
420	2 500	320

Table 2 Test Pressures for Low Pressure Test

(*Clause* 6.9)

PN Rating	Class Rating	Test Pressure, Bar ± 10%
(1)	(2)	(3)
16		2
20	150	2
25		2
40		3
50	300	4
64	400	5
100	600	7
150	900	—
250	1 500	—
420	2 500	—

7 TEST APPARATUS

7.1 Typical arrangements of the fire test equipments are shown in Fig. 5 and 6. Other means may be used to pressurise the system, provided the alternative sources meet the other requirements of this standard and assure adequate safety.

7.2 The test equipment shall be so fabricated and erected that test valve is not subjected to any externally applied stresses which may affect the result.

7.3 The test equipment shall be so designed that if the pipework immediately upstream of the valve is larger than DN 25 nominal size or larger than one half of the test valve nominal size, pipework shall be heated/enveloped in flame for a distance of 150 mm from the test valve end connections. The pipework downstream of the test valve shall be between DN 15 and DN 25 nominal size and shall have a slope of 1 in 12 (5°) minimum to allow any water in the bore of the valve to flow out, avoiding any entrapment of the same. Downstream of valve can have ecentric reducer, if needed.

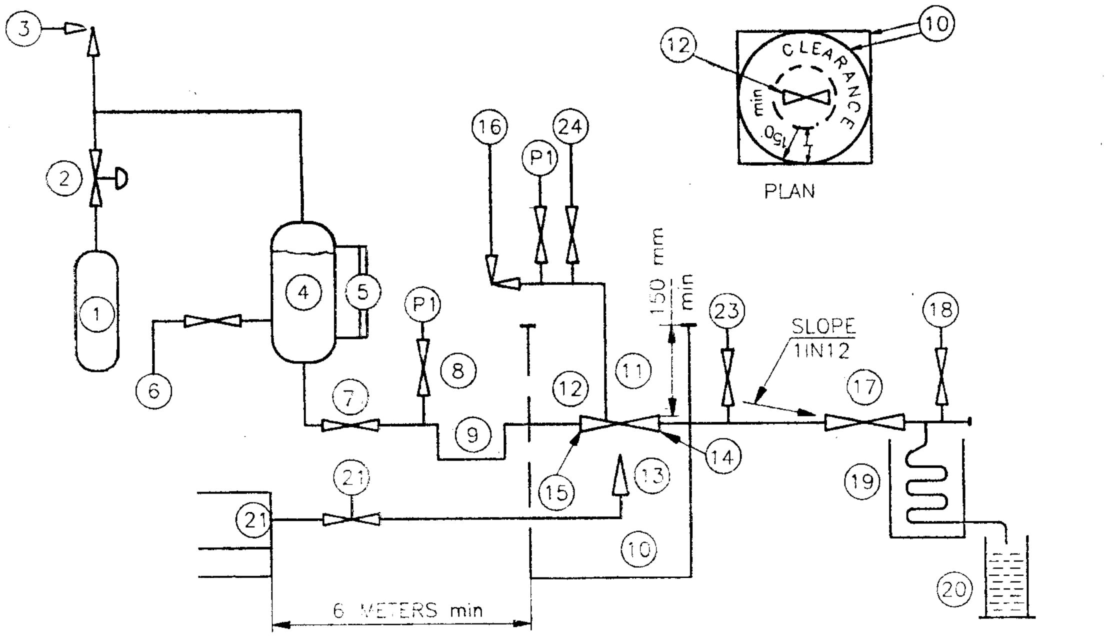


Fig. 5 Recommended Fire Test System Using Compressed Gas as the Pressure Source

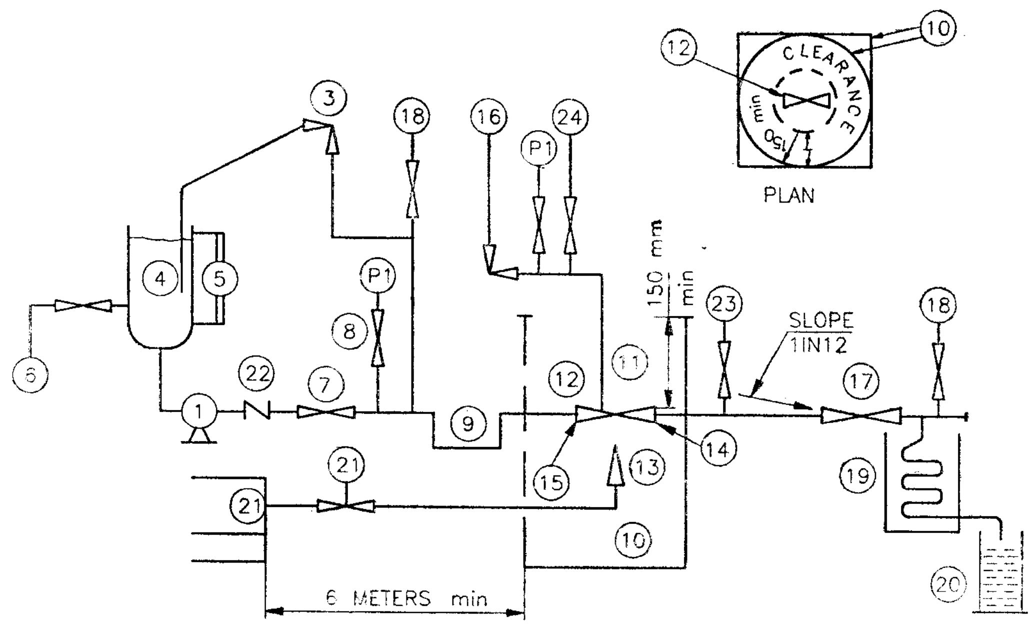


Fig. 6 Recommended Fire Test System Using a Pump as the Pressure Source

7.4 Pressure Gauges (P_1 and P_2)

Industrial Pressure Gauges having a full scale reading of not more than four times and not less than one and a half times the system test pressure and relief pressure (*see* **6.8** and **6.9**). Each test gauge used, shall have an accuracy of not less than 1 percent of the maximum scale value at any point, when tested over the entire scale, with readings taken both up and down the scale. They shall be calibrated and certified.

7.5 Calorimeter Cubes

The calorimeter cubes shall be as specified in **6.4**. They shall be free of scales before exposure to the flame.

7.6 Thermocouples

The accuracy of the thermocouples shall be ± 0·5 percent for Platinum/Rhodium type and ± 0·75 percent for Nickel/chrome-Nickel/Aluminium type as stated in IS 2055 : 1962 and IS 2054 : 1962 respectively. They shall be calibrated and certified.

NOTES

1 Subject to agreement, other types of thermocouples may be used, provided they are suitable and the accuracy in temperatures encountered fall within the same limits as stated above.

2 Different thermocouples give different outputs, hence separate instruments will be required for readings if the type of thermocouple is changed.

8 TEST PROCEDURE

8.0 Numbers given in the paranthesis alongwith the part/instrument name given in **8.1** to **8.18** refer to the items listed in Fig. 5 and 6.

8.1 Mount the test valve (12) in the apparatus so that the stem and bore are in horizontal position.

8.2 Locate the flame thermocouples (15) and the calorimeter cubes (14) in the positions as shown in Fig. 1 and 2 as appropriate.

8.3 With the test valve (12) in partially open position, open the water supply valve (6), the shut off valve (7) and the vent valves (23) and (24), keeping the shut off valve (17) closed. Flood the system with water and purge air completely.

8.4 Close the vent valves (23) and (24). Close the test valve (12) and pressurize the system to 1·5 times the test pressure as per Table 1 and check the system for leakages. Eliminate the leakages as necessary.

8.5 The test valve and upstream of the test valve should now be completely filled with water. Open the shut-off (17) and the vent valve (23) and drain the downstream system completely, if necessary, by blowing through the vent valve (23).

8.6 Pressurize the system to appropriate test pressure as specified in Table 1 and maintain this pressure during the burn and cooling down period.

NOTE — A one-time momentary loss of 50 percent of the test pressure is permissible during the test, provided the test pressure is recovered/restored within 2 minutes.

8.7 Record the water level in the vessel (5). Empty the graduated container (20).

8.8 Open the fuel supply (21) and establish flame enveloping the valve and its accessories. Monitor the flame temperature with thermocouples (15). They should reach the average temperature within 2 minutes with readings as specified in **6.3**.

8.9 Monitor the calorimeter cube temperatures (14) as specified in **6.5** and maintain them.

8.10 Record the instrument and pressure gauge readings every 2 minutes during the burning period.

8.11 At the end of the burn period of 30 minutes, shut off the fuel supply (21).

8.12 Immediately determine and record the amount of water collected in the conta ner (20) to establish the total through valve leakage during the burn period. Deduct the volume of water trapped in the body cavity from this volume if the valve is of upstream sealing type as specified in **6.7**.

8.13 Allow the valve to cool down naturally or force cool the valve to 93°C or below and note the time. Record the amount of water collected during the cool down period.

NOTES

1 For safety considerations, the manufacturer's advice should be sought when force cooling the valve from high temperature.

2 The internal parts of the valve may remain at a significantly higher temperature than the external surface of the valve. Sufficient time must be allowed to equalise the temperatures as far as practicable.

3 Force cooling some times may cool the body fasteners faster. In such cases, force cooling is not to be carried out.

4 The temperatures of 93°C refers to valve internals, but can be measured with body thermocouples/calorimeters if no other instrumentation is available.

8.14 Record the water level in the vessel (5) to calculate the external leakage. Also if possible, record the external leakage. If the valve is fitted with an integral pressure relief device, then the leakage through this should be recorded as an external leakage only.

8.15 For valves with maximum working pressure of 110 bar or lower reduce the system test pressure to 'Low Pressure Test' value as given

in Table 2. Measure the through valve leakage and external leakage for a period of 5 minutes.

8.16 Raise the system pressure to the test pressure as per Table 1. Close the shut-off valve (17) and operate the test valve against test pressure once to full open position.

8.17 Measure the external leakage for a period of 5 minutes after the valve is in open position and the system is under full test pressure as per Table 1.

8.18 Adjustment During Test

No adjustments may be made to the test valve during the fire, low-pressure or operational test.

9 PERFORMANCE REQUIREMENTS

9.1 Through Seat Leakage During Burn Period (High Pressure Test)

The maximum through seat leakage at high test pressure during burn pericd will be as given below (*see also* **8.12**):

Burn Period	30 minutes
Leakage Rate	Not to exceed 16/ml/mm/min

9.2 External Leakage during Burn and Cool Down Period (High Pressure Test)

The maximum external leakage during the burn and cool down period shall be as given below (*ses also* **8.14**):

Total Elapsed Period	30 minutes plus cool down time to 93°C or less
Leakage Rate	Not to exceed 4 ml/mm/min

9.3 Through Seat Leakage After Cool Down (Low Pressure Test)

The maximum through seat leakage at low test pressure after cool down shall be as given below (*see also* **8.15**):

Test Period	5 minutes
Leakage Rate	Not to exceed 1·6 ml/mm/min

9.4 External Leakage After Cool Down (Low Pressure Test)

The maximum external leakage at low test pressure after cool down (with valve in closed position) shall be as given below (*see also* **8.15**):

Test Period	5 minutes
Leakage Rate	Not to exceed 0·8 ml/mm/min

9.5 External Leakage After Operational Test (Full Open Position) at High Test Pressure

The maximum external leakage after the operational test shall be as given below (*see also* **8.17**):

Test Period	5 minutes
Leakage Rate	Not to exceed 8 ml/mm/min

10 VALVE QUALIFICATION

10.1 Instead of testing each size and nominal pressure rating of a given valve design, other valves of the same basic design as the test valve and of the same non-metallic materials with respect to seat-to-closure member seal, seal-to-body seal, stem seal and body joint and seal may be qualified subject to limitations mentioned below in **10.2** to **10.5**.

10.2 One test valve may be used to qualify valves larger than the test valve, not exceeding twice the size of the test valve, except, that a DN 400 valve will qualify all larger size valves as per Table 3.

Table 3 Other Valves Qualified According to Size

Test Valve Size (DN)	Valve Sizes Qualified (DN)
(1)	(2)
6	6, 10, 15
10	10, 15, 20
15	15, 20, 25
25	25, 32, 40, 50
32	32, 40, 50, 65
40	40, 50, 65, 80
50	50, 65, 80, 100
65	65, 80, 100, 125
80	80, 100, 125, 150
100	100, 125, 150, 200
125	125, 150, 200, 250
150	150, 200, 250, 300
200	200, 250, 300, 350, 400
250	250, 300, 350, 400, 450, 500
300	300, 350, 400, 450, 500, 600
350	350, 400, 450, 500, 600, 700
400	400 and larger

10.3 One test valve may be used to qualify valves with higher pressure ratings no greater than twice the pressure rating of the test valve as per Tables 4 and 5.

Table 4 Other Valves Qualified by PN Rating

(*Clause* 10.3)

Rating of Test Valve (PN)	Valve Pressure Rating Qualified (PN)
(1)	(2)
10	10, 16, 20
16	16, 20, 25
20	20, 25, 40
25	25, 40, 50
40	40, 50
50	50, 100
100	100, 150
150	150, 250
250	250, 420
420	420

Table 5 Other Valves Qualified by Class Rating

(*Clause* 10.3)

Rating of Test Valve (Class)	Valve Pressure Ratings Qualified (Class)
(1)	(2)
150	150, 300
300	300, 400, 600
400	400, 600, 800
600	600, 800, 900
800	800, 900, 1 500
900	900, 1 500
1 500	1 500, 2 500
2 500	2 500

10.4 The nominal size of the test valve is determined by the size of the end connections.

10.5 The types of valve body ends are not considered in this standard, however, the mass of the valve is determined by the type of body end connection. So far as the qualification to this standard is concerned and providing all other qualification criteria have been met, valves with different type of end connection from the test valve will also qualify, provided that:

a) their mass is greater than that of the test valve, or

b) their mass is not less than 90 percent of the test valve.

11 TEST REPORT

The test report shall include the following information:

a) The number of the product standard.

b) Whether a gear box is fitted to the test valve or not and, if fitted, the type of box, manufacturer's name, model number and mechanical advantage.

c) The size and the PN or class rating of the test valve.

d) Time of test start, that is ignition of burners.

e) Temperature recorded at start and at 2 min intervals throughout duration of test (*see* **8.10**) with individual records for each thermocouple.

f) Through-seat leakage (high pressure test) during burn period (*see* **9.1**).

g) External leakage (high pressure test) during burn and cool-down periods (*see* **9.2**).

h) Time required for valve to cool down to 93°C (*see* **8.13**) and if the valve was allowed to cool naturally or force cooled.

j) Through-seat leakage (low test pressure) after cool-down (*see* **9.3**).

k) External leakage (low test pressure) after cool-down (*see* **9.4**).

m) Whether the test valve unseated and moved to the fully open position (*see* **8.16**).

n) External leakage in fully open position (*see* **9.5**).

p) If the valve is asymmetric and intended for bi-directional installation, the test results in both directions.

NOTE — Guidance on additional information that should be included in the test report is given in Annex A.

12 CERTIFICATION

12.1 Records of the tests upon which certification is based shall be available for the purchaser's review upon request.

12.2 Certification and qualification is invalid if any design change/modification is carried out, in which case, retesting has to be performed.

12.3 Certificate will be valid till the manufacturer changes his design or 5 years whichever is earlier from the date of test.

ANNEX A

[*Clause* 11 (*Note*)]

ADDITIONAL INFORMATION TO BE INCLUDED IN THE TEST REPORT

A-1 The following additional information should be included in the test report:

a) Manufacturer's name and address.

b) Date of fire test.

c) Place of fire test.

d) Number of this Indian Standard.

e) Full description of the valve tested including nominal size rating, type, bore, material of the body, bonnet and trim, mass, and manufacturer's identification mark.

f) Manufacturer's sectional drawing of the valve and detailed parts list of components identified by drawing or reference number, revision and date of issue of documents.

g) Whether the test valve complied with the requirements of standards or not, and if positive, then the size and ratings of valve qualified by the test.

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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Review of Indian Standards

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(First Revision)

(*Page* 1, *clause* **1.1**, *last line*) — Substitute the following for the existing:

'when exposed to defined fire conditions.'

(*Page* 1, *clause* **1.3**, *fourth line*) — Substitute 'and/or' *for* 'and'.

(*Page* 1, *clause* **1.4**, *first sentence*) — Substitute the following for the existing matter:

'This standard does not cover the requirements for valve actuators. However, valves fitted with gear box or other such manual device shall be tested along with the device.'

(*Page* 1, *clause* **1.5**, *sixth line*) — Substitute 'purchaser and the manufacturer' *for* 'manufacturer and buyer/authority witnessing the test'.

(*Page* 1, *clause* **3.3**, *first line*) — Substitute 'end' *for* 'and'.

(*Page* 1, *clause* **4.3**, *seventh line*) — Substitute 'impact' *for* 'force'.

(*Page* 2, *clause* **5.2**, *fifth line*) — Substitute 'refurbished' *for* 'refurnished'.

(*Page* 2, *clause* **5.4**, *first sentence*) — Delete.

(*Page* 2, *clause* **5.4**, *seventh line*) — Delete the word 'paragraph'.

(*Page* 2, *clause* **5.4**) — Insert the following note at the end of clause:

'NOTE — Gear box would cover such other manual device also used to operate the valve.'

(*Page* 2, *clause* **6.4**, *last sentence*) — Substitute 'purchaser' *for* 'witnessing authority'.

(*Page* 3, *clause* **6.6**, *first sentence*) — Substitute 'purchaser and the manufacturer' *for* 'manufacturer, purchaser and witnessing authority'.

(*Page* 3, *clause* **6.6**, *sixth line*) — Substitute '60°' *for* '60°C'.

(*Page* 3, *clause* **6.6**, *third sentence*) — Insert the following after the word 'recorded':

'The temperature of thermocouple reading shall be as defined in **6.5**.'

(*Page* 4, *clause* **6.8**) — Substitute 'High Pressure Test' *for* 'High Test Pressure'.

(*Page* 4, *clause* **6.8.1**, *first line*) — Insert 'of rating not covered in Table 1' after the word 'valves'.

(*Page* 5, *clause* **7.3**, *sixth line*) — Insert words 'at least' before '150 mm'.

(*Page* 5, *Fig.* 5 *and Fig.* 6) — The pressure gauge connected to vent valve 24 be designated as 'P2'.

(*Page* 5, *Fig.* 5) — Insert the following table of legends in the figure:

LEGEND

1. Pressure source
2. Pressure regulator
3. Relief valve
4. Vessel for water
5. Calibrated sight gauge (or similar device)
6. Water supply
7. Shut-off valve
8. Pressure gauge (P1)
9. Piping arranged to provide vapor trap
10. Enclosure for test. The horizontal clearance between any part of the valve and the enclosure shall be 150 mm, *Min*
11. Minimum height of the enclosure shall be 150 mm above the top of the valve
12. Test valve and stem mounted horizontally
13. Fuel gas burner
14. Calorimeter cubes
15. Flame temperature thermocouples
16. Pressure gauge and relief valve connected to centre cavity of valve (P2)
17. Shut-off valve
18. Vent valve
19. Condenser
20. Calibrated container
21. Fuel gas inlet
22. Vent valve
23. Vent valve

(*Page* 5, *Fig.* 6) — Vent valve '18' near the relief valve '3' be designated as '23'.

(*Page* 5, *Fig.* 6) — Inset the following table of legends in the figure:

LEGEND

1. Pressure source
2. Relief valve
3. Vessel for water
4. Calibrated sight gauge (or similar device)
5. Water supply
6. Shut-off valve
7. Pressure gauge (P1)
8. Piping arranged to provide vapor trap
9. Enclosure for test. The horizontal clearance between any part of the valve and the enclosure shall be 150 mm, *Min*
10. Minimum height of the enclosure shall be 150 mm above the top of the valve
11. Test valve and stem mounted horizontally
12. Fuel gas burner
13. Calorimeter cubes
14. Flame temperature thermocouples
15. Pressure gauge and relief valve connected to centre cavity of valve (P2)
16. Shut-off valve
17. Vent valve
18 Condenser
19. Calibrated container
20. Fuel gas inlet
21. Check valve
22. Vent valve
23. Vent valve

(*Page* 6, *clause* **8.5**, *fourth line*) — Substitute '(18)' *for* '(23)'.

(*Page* 6, *clause* **8.6**, *first line*) — Substitute the following for the existing:

'Maintain the system at appropriate test.'

(*Page* 7, *clause* **10.1**, *fifth line*) — Substitute 'seat-to-body' *for* 'seal-to-body'.

(*Page* 7, *Table* 3, *third entry*) — Insert the following after third entry in col 1 and 2 of table:

'(1)	(2)
20	20, 25, 32, 40'

(*Page* 8, *clause* **10.5**, *first sentence*) — Substitute the following for the existing:

'The types of valve body ends are not considered in this standard, however, the mass of the valve also depends on the type of body end connection.'

(HMD 17)

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